LIST OF CONTENTS

NUMBER 1

E. Taşdemiroğlu	1	Wind energy assessment in Turkey
Daniel Sperling	11	Brazil, ethanol and the process of system change
Ho-Ming Yeh, Shau-Wei Tsai and **Wang-Tang Hsieh**	25	Time–temperature variations in the storage zone of salt-gradient solar ponds
S. S. Penner, D. F. Wiesenhahn and **C.-P. Li**	33	Incinerator production, fate and health effects of poly-chlorinated dioxins and furans
S. J. Gale	45	The premium for self-sufficiency in liquid fuels
N. K. Bansal, Anil Kumar and **A. K. Batra**	53	Performance equations for a closed-loop water-heating system using a solar air-heating collector
N. S. Al-Baharna	59	Energy assessment of Bahrain
Michael E. Brady	67	Solar power subsidization
R. Herendeen and **S. Brown**	75	A comparative analysis of net energy from woody biomass
J. P. Painuly, Ashok Gadgil and **T. V. Natarajan**	85	Socio-economic constraints on the design of solar domestic hot-water systems for India
		Note
G. C. Aggarwal	97	Energy and economic returns from legume crops as green manure and fodder
	I	Software Survey Section

NUMBER 2

Editorial	i	Use of Authors' Typescripts for Printing in *Energy*
B. W. Ang	101	Structural changes and energy-demand forecasting in industry with applications to two newly industrialized countries
R. Srinivasan, V. Bahel and **H. Bakhsh**	113	Comparison of models for estimating solar radiation in arid and semi-arid regions
Anastassios Pouris	117	The cost of photovoltaic cells in South Africa
Gregory A. Turk, Thomas B. Cobb, Donald J. Jankowski, Alan M. Wolsky and **Frederick T. Sparrow**	123	CO_2 transport: a new application of the assignment problem
V. Bahel, H. Bakhsh and **R. Srinivasan**	131	A correlation for estimation of global solar radiation

T. Y. Yan	137	An incremental model for coal evaluation—I. Liquefaction
M. Ishida, D. Zheng and **T. Akehata**	147	Evaluation of a chemical-looping-combustion power-generation system by graphic exergy analysis
Gabriel Miller, Dean Corren, Peter Armstrong and **Joseph Franceschi**	155	A study of an axial-flow turbine for kinetic hydro power generation
Sheldon M. Jeter	163	A concept for an innovative high-temperature heat pump
V. Sundar	171	Wave-power potential off the South-East coast of India
	I	Software Survey Section
		Guidelines for the Preparation of Typescripts for Direct Reproduction

NUMBER 3/4

STATUS OF SOLAR THERMAL RESEARCH

Foreword 177

Frank Wilkins: Changing directions of the Solar Thermal Technology Program 179

B. P. Gupta: Status and progress in solar thermal research and technology 187

Paul Schissel, H. H. Neidlinger and A. W. Czanderna: Silvered polymer reflectors 197

B. A. Benson: Silver–polymer film development 203

J. Hull, J. Lauer and D. Broadbent: Holographic solar concentrators 209

J. O'Gallagher, R. Winston, D. Suresh and C. T. Brown: Design and test of an optimized secondary concentrator with potential cost benefits for solar energy conversion 217

Mark S. Bohn: Experimental investigation of the direct absorption receiver concept 227

S. H. Bomar Jr, G. B. Freeman and J. M. Lefferdo: Performance of materials under hyper-thermal solar exposure 235

K. Ramohalli, B. Butler and G. Visvanathan: Advanced composites for stressed-membrane heliostats 245

J. A. Peterka, B. Bienkiewicz, N. Hosoya and J. E. Cermak: Heliostat mean wind load reduction 261

A. Mesarwi, Y. Sun and A. Ignatiev: High-flux photodegradation of solar materials: stainless steel 269

A. Z. Moshfegh and A. Ignatiev: Photo-enhancement of the catalytic methanation reaction 277

William Mok, Maninder Hunjan, Michael J. Antal Jr, Robert J. Evans and Thomas A. Milne: Direct observation by molecular beam mass spectrometry of the photolytic enhancement of hydrocarbon reactions by concentrated sunlight 283

K.-Y. Wang and R. Benito: Non-equilibrium chemical reactions with rapid heating and quenching 291

J. L. Graham and B. Dellinger: Solar thermal/photolytic destruction of hazardous organic wastes 303

V. K. Mathur and E. H. Wong: Production of fuels and chemicals using solar photo-thermochemistry 311

W. E. Wentworth, C. F. Batten and Gong Wei: The photo-assisted thermal decomposition of methanol and isopropanol in a fluidized bed 319

Allan Lewandowski and David Simms: An assessment of linear Fresnel lens concentrators for thermal applications 333

Software Survey Section I

NUMBER 5

Paul C. Stern, Elliot Aronson, John M. Darley, Willett Kempton, Daniel H. Hill, Eric Hirst and **Thomas J. Wilbanks** 339 Answering behavioral questions about energy efficiency in buildings

M. Zaheer-uddin, R. E. Rink and **V. G. Gourishankar** 355 A design criterion for a solar-assisted heat pump system

M. Hussain 369 Bangladesh energy resources and renewable energy prospects

S. J. Tarwadi and **V. D. Chauhan** 375 Seaweed biomass as a source of energy

John B. Robinson 379 An embarrassment of riches: Canada's energy supply resources

John B. Robinson 403 Insurmountable opportunities? Canada's energy efficiency resources

Mahir Arıkol, Gülseren Ünlü İzmir and **Sibel Özdoğan** 419 Survey of industrial energy requirements: findings for the Turkish food industry

I Software Survey Section

NUMBER 6

Abdel-Latif A. Qahwash 423 An optimal algorithm for drilling strategy

David B. Reister 427 The link between energy and GDP in developing countries

Isaac Turiel, Paul Craig, Mark Levine, Jim McMahon, George McCollister, Beverly Hesterberg and **Michael Robinson** 435 Estimation of energy intensity by end-use for commercial buildings

Barbara Shohl Wagner and **Richard C. Diamond** 447 The Kansas City warm room project: economics, energy savings and health and comfort impacts

Edward Vine, Rick Diamond and **Rich Szydlowski** 459 Domestic hot water consumption in four low-income apartment buildings

P. H. Wallman, B. S. Pedersen, R. J. Mowris, W. J. Fisk and **D. T. Grimsrud** 469 Assessment of residential exhaust-air heat pump applications in the United States

J. Y. San, W. M. Worek and **Z. Lavan** 485 Second-law analysis of a two-dimensional regenerator

S. C. Bhattacharya and **Pham Quang Khai** 497 Kinetics of anaerobic cowdung digestion

M. Baba 501 Wave power potential off the south-west Indian coast

W. van Gool 509 The value of energy carriers

Note

Benoy B. Bhowmik and **Sharmila Roy** 519 A phenosafranin–amine photoelectrochemical cell

I Software Survey Section

NUMBER 7

John B. Woodward 523 Part-load optima in bottoming-cycles

Bobby E. Apostolakis 531 The role of energy in production functions for southern European economies

Kenneth E. Train and **Patrice C. Ignelzi** 543 The economic value of energy-saving investments by commercial and industrial firms

John M. Gowdy and **Jack L. Miller** 555 Energy use in the U.S. service sector: an input–output analysis

Christos A. Frangopoulos 563 Thermo-economic functional analysis and optimization

D. Michalopoulos 573 An analytical and experimental investigation of radial heat transfer in long cylinders

T. Y. Yan and **J. R. White** 579 Economics of electric power generation options and sulfur oxide emission control

M. Shyam, S. R. Verma and **B. S. Pathak** 589 Physico-chemical properties of plant oils and blends in diesel and kerosene oils

Mitali De and **Keith W. Hipel** 599 A fuzzy multicriteria model for comparing energy projects

Said M. A. Ibrahim 615 The thermal behavior of thermally insulated and uninsulated buildings

I Software Survey Section

NUMBER 8/9

COAL GASIFICATION: DIRECT APPLICATIONS AND SYNTHESES OF CHEMICALS AND FUELS

ABSTRACT xi

ACKNOWLEDGMENTS xi

CHAPTER 1. SUMMARY OF RESEARCH RECOMMENDATIONS 623

CHAPTER 2. OVERVIEW OF COAL-GASIFICATION R&D NEEDS 627

2.1. Introduction 627
2.2. Process Synthesis 627
2.3. Gasifiers for Electricity Generation 628
2.4. Gasification for Syngas Production 628
2.5. Gasification for Syntheses of Fuels and Chemicals 629
2.6. Gasifiers for Fuel Cells (FCs) 630
2.7. Gasification Catalysts 631
2.8. Gas Cleanup 631
2.9. Summary of Research Recommendations on Environmental Issues 633
2.10. Coal Beneficiation and Feed Preparation: Solids Processing 634
2.11. Applications of Advanced Diagnostics to Coal-Gasification Systems 636
2.12. Fundamentals of Coal Conversion and Relation to Coal Properties 636

CHAPTER 3. GASIFICATION FOR ELECTRICITY GENERATION 639

Sections 3.1 and 3.2 were written by S. B. Alpert, S. S. Penner and D. F. Wiesenhahn, Sec. 3.3-3 by P. B. Tarman, and the remaining subsections of Sec. 3.3, as well as Sec. 3.4, by S. S. Penner and D. F. Wiesenhahn with advice and inputs from correspondents identified in the subsections.

3.1. Integrated Coal-Gasification Combined Cycles (IGCC) . . . 639
3.1-1. Introduction 639
3.1-2. IGCC System Status 639
3.1-3. Advantages of IGCCs 641
3.1-4. Future Utilization of IGCCs 641
References for Section 3.1 643
3.2. The Cool Water IGCC 643
3.2-1. General Features 643
3.2-2. Process Description 643
3.2-3. Performance Results 643
References for Section 3.2 646
3.3. Selected Gasifiers for IGCC Plants 646
3.3-1. The Texaco Coal-Gasification Process (TCGP) . . 646
3.3-2. The Shell Coal-Gasification Process (SCGP) . . . 648
3.3-3. The U-GAS Process 651
3.3-4. Other Gasifiers 659
References for Section 3.3 660

3.4. Research Recommendations for Improving Gasifiers 660
3.4-1. Fouling and Slagging 660
3.4-2. Corrosion and Fatigue 660
3.4-3. High-Temperature Sulfur Removal 660
3.4-4. Gasifiers for Low-Rank Coals 661
3.4-5. Low-Cost Gas Separation and Air Enrichment . . . 661
References for Section 3.4 661

CHAPTER 4. COAL GASIFICATION FOR SNG PRODUCTION 663
This chapter has been written by Kermit E. Woodcock and Vernon L. Hill.

4.1. Introduction 663
4.1-1. The Great Plains Coal Gasification Plant (GPCGP) . 663
4.1-2. General Thermodynamic Considerations 663
4.1-3. General Flow Sheets 665
4.2. Advanced Gasification Technology for SNG 666
4.2-1. BGC/Lurgi Slagging Gasifier 667
4.2-2. KRW (Kellogg-Rust-Westinghouse) Ash-Agglomerating, Fluidized-Bed Gasifier 667
4.2-3. Rheinbraun AG, Hydrogasification 669
4.2-4. Catalytic Coal Gasification 670
4.3. Catalytic Methanation 670
4.3-1. Chemistry and Thermodynamics 670
4.3-2. Catalysis 671
4.3-3. Commercial Processes 673
4.3-4. Direct Methanation 673
4.3-5. Comflux Process (Fluid-Bed Methanation) 675
4.3-6. HICOM 675
4.3-7. Liquid-Phase Methanation 679
4.4. Acid-Gas Removal 681
4.4-1. Commercial Processes 681
4.4-2. Advanced Technologies 681
4.5. SNG Economics 684
4.6. Research and Development Needs 685
4.6-1. Engineering Development and Testing 685
4.6-2. Technology Base Data for Design 686
4.6-3. Basic Research Needs for Advanced Systems . . . 686
References 686

CHAPTER 5. GASIFICATION FOR THE SYNTHESES OF FUELS AND CHEMICALS . 689
This chapter has been written by W. O. Haag, J. C. Kuo and I. Wender.

5.1. Catalytic Conversion of Synthesis Gas to Fuels and Chemicals . 689
5.1-1. Introduction 689
5.1-2. Synthesis of Methanol and Higher Oxygenated Compounds 690
5.1-3. SG as a Source of Chemicals 698
5.1-4. Fischer-Tropsch Synthesis 701

5.1-5. Syntheses of Chemicals Using SG, CO or Methanol Plus Other Chemicals 708

5.1-6. Other Chemicals from SG, Methanol and CO; Emerging Processes 710

5.2. Catalytic Processing of Synthesis-Gas-Derived Products . . . 712

5.2-1. Introduction 712

5.2-2. Methanol-to-Gasoline (MTG) 712

5.2-3. Methanol Conversion to Olefins and Diesel 713

5.2-4. Processing of Fischer-Tropsch Products 714

5.3. Interaction of Coal Gasifiers with Synthesis Gas Conversion Processes 716

5.3-1. Introduction 716

5.3-2. H_2+CO Partial Pressure Requirements 716

5.3-3. H_2/CO Ratio Requirement 718

5.3-4. Purity Requirements for Synthesis Gas 720

5.4. Zeolites as Shape-Selective Catalysts 720

5.4-1. Introduction 720

5.4-2. Classification of Zeolites 721

5.4-3. Intrinsic Catalytic Properties of Zeolites 723

5.4-4. Shape Selectivity 723

References 725

CHAPTER 6. COAL GASIFICATION IN FUEL-CELL APPLICATIONS 729

6.1. Overview of FCs 729

This section has been written by A. J. Appleby.

6.1-1. Introduction 729

6.1-2. The FC as a Direct Energy-Conversion Device . . . 730

6.1-3. Alkaline Fuel Cells (AFCs) 731

6.1-4. Acid Fuel Cells 733

6.1-5. Molten Carbonate Fuel Cells (MCFCs) 735

6.1-6. Solid Oxide Fuel Cells (SOFCs) 737

6.1-7. Conclusions 738

6.2. Coal Gasifiers for FCs 738

This section has been abstracted by S. S. Penner and D. F. Wiesenhahn from viewgraphs presented by D. Rastler at the Second Technical Meeting of COGARN.

6.2-1. The Site-Specific UPA Design 738

6.2-2. The Site-Specific SCE Design 742

6.2-3. Conclusions 744

6.2-4. Research Needs on Gasifier-PAFC Systems 744

6.2-5. Other Gasifier-FC Systems 744

References 744

CHAPTER 7. USE OF CATALYSTS DURING GASIFICATION 747

This chapter has been prepared by S. S. Penner and D. F. Wiesenhahn.

7.1. Selected Examples of Current Research 747

7.1-1. Introduction 747

7.1-2. Results from the 1985 International Coal Science Conference 747

7.1-3. Catalytic Conversions at Reduced Temperatures . . . 750
References for Section 7.1 755
7.2. The Exxon Process for Catalytic Coal Gasification 755
7.2-1. Process Features 755
7.2-2. Development Work 756
7.2-3. Fluid-Bed Slurry Dryer (FBSD) 760
7.2-4. Mechanisms of Catalysis and Selection of Alternative Catalysts 760
7.2-5. Environmental Aspects of CCG 762
7.2-6. Large Pilot Plant 762
References for Section 7.2 762
7.3. Recommended Research for Syngas Production from Coal . . 763

CHAPTER 8. GAS-CLEANING PROCESSES FOR COAL GASIFICATION 765
This chapter has been written by Robert A. Magee. The Appendix to this chapter has been written by J. F. Elliott.

8.1. Introduction 765
8.2. Gas Cleanup Systems 766
8.3. Quenching, Cooling and Heat Recovery 767
8.4. Removal of Particles, Aerosols and Inorganic Compounds . . 767
8.5. Acid-Gas Removal and Sulfur Recovery 768
8.5-1. Solid Sorbents and In-Bed Desulfurization 769
8.5-2. Sulfur-Redox Processes 770
References 770
Appendix: Slag for In-Bed Sulfur Removal 771

CHAPTER 9. ENVIRONMENTAL ISSUES 775
This chapter has been written by Edward S. Rubin.

9.1. Introduction 775
9.2. Overview of US Regulatory Policy 775
9.2-1. Trends in Environmental Regulation 775
9.2-2. Elements of Current Policy 776
9.2-3. Future Regulatory Directions 779
9.3. Environmental Emissions from Coal Gasification 779
9.3-1. Process Overview 779
9.3-2. Recent Characterization Studies 781
9.3-3. Methods of Environmental Control 795
9.4. Experience at Commercial Facilities 798
9.4-1. The Great Plains Gasification Plant 798
9.4-2. The Cool Water Gasification Facility 799
9.5. Research Needs and Priorities 800
9.5-1. Current Control Technology 800
9.5-2. Future Environmental Requirements 803
9.5-3. Advanced Control Technology 803
References 804

CHAPTER 10. COAL BENEFICIATION 805
This chapter has been written by Suman P. N. Singh.

10-1. Background 805

10-2. Current Commercial Practice 806
10-3. Recent Advances in Coal Cleaning 810
10-4. Conclusions 810
References 812

CHAPTER 11. OPTICAL DIAGNOSTICS FOR IN SITU MEASUREMENTS IN COMBUSTION ENVIRONMENTS CONTAINING COAL PARTICLES . . 813

This chapter has been written by D. R. Hardesty and D. K. Ottesen.

Abstract 813
11.1. Introduction 813
11.2. Diagnostics Requirements 813
11.2-1. Characteristics of Class I Flows 814
11.2-2. Diagnostics Considerations for Class I Flows 815
11.2-3. Characteristics of Class II Flows 816
11.2-4. Diagnostics Considerations for Class II Flows 816
11.3. Gas-Phase Temperature Measurement 816
11.3-1. Raman Scattering Techniques 816
11.3-2. Fluorescence and Absorption Techniques 820
11.4. Gas-Phase Species Concentration Measurement 821
11.4-1. Raman Scattering Techniques 821
11.4-2. Fluorescence and Absorption Techniques 822
11.5. Particle Size, Number Density and Temperature Measurements 823
11.5-1. Single Particle Counter, SPC (Scattering) Instruments 824
11.5-2. Imaging Methods for Single-Particle Counting 827
11.5-3. Ensemble Methods for Analysis of Particulates . . . 828
11.6. Velocity Measurements in Particle-Laden Flows 830
11.6-1. Application of Laser-Doppler Velocimetry to Coal-Derived Flows 830
11.7. Particulate Composition Measurement by Laser-Spark Spectroscopy (LASS) 831
References 836

CHAPTER 12. FUNDAMENTALS OF COAL CONVERSION AND RELATION TO COAL PROPERTIES 837

This chapter has been written by P. R. Solomon and J. M. Beér. The Appendix is by J. P. Longwell

12.1. Introduction 837
12.2. Coal Characterization 838
12.2-1. Organic Structure (Functional Groups) 838
12.2-2. Viscosity 838
12.2-3. Pyrolysis 838
12.2-4. Reactivity 838
12.2-5. Mineral Matter 838
12.3. Fundamental Processes in Gasification and Partial Gasification 839
12.3-1. Heat Transfer 839
12.3-2. Pyrolysis Rates 841
12.3-3. Devolatilization: Formation of Gases, Condensables and Char 842

12.4. The Behavior of Coal Mineral Matter in Gasification 852
12.4-1. The Nature of Mineral Matter in Coal and Its Characteristics 852
12.4-2. Behavior During Heating 853
12.4-3. Mineralogical Transformations at High Temperatures 853
12.4-4. Ash Agglomeration 853
12.5. Mathematical Modeling 856
12.5-1. Status of Model Development 856
12.6. Research Recommendations 856
12.6-1. Coal Characterization 856
12.6-2. Fundamental Processes in Gasification and Partial Gasification 856
12.6-3. Mathematical Modeling of Gasification Processes . . 858
References 858
Appendix: Effect of CaO on Combined Fluidized-Bed Gasification and Pyrolysis 861

CHAPTER 13. GAS SUPPLIES AND SEPARATION; ASH DISPOSAL; MATERIALS FOR GASIFIERS 863
13.1. Gas Supplies and Separation 863
This section has been abstracted by S. S. Penner and D. F. Wiesenhahn from viewgraphs and references supplied by A. Smith.
13.1-1. Introduction 863
13.1-2. Cryogenic Air Separation 863
13.1-3. The MOLTOX System 864
13.1-4. Other Air-Separation Systems 867
13.1-5. Research Needs 867
References for Section 13.1 867
13.2. Utilization and Disposal of Ash from Gasifiers 867
This section has been written by S. B. Alpert.
13.2-1. Environmental-Impact Studies 869
13.3. Construction Materials for Coal Gasification 869
This section has been written by M. T. Simnad
13.3-1. Introduction 869
13.3-2. High-Temperature Corrosion 869
13.3-3. Low-Temperature Corrosion 875
13.3-4. Erosive Wear 875
13.3-5. Mechanical Properties 875
13.3-6. Materials for Syngas Coolers of Slagging Gasifiers 877
13.3-7. Nuclear Heat Steam-Gasification of Coal 880
References for Section 13.3 881

CHAPTER 14. INTRODUCTION TO COSTING 885
This chapter has been written by D. Pescarolo.

APPENDIX: GENERAL REMARKS ON COAL-GASIFICATION SYSTEMS 889
This Appendix has been prepared by S. S. Penner and D. F. Wiesenhahn and is based on a presentation by R. Shinnar.

A-1. Stoichiometry of Coal Conversion 889
A-2. Gasifier Efficiency 890
A-3. Fluidized-Bed Gasifiers 892
References 894

GLOSSARY OF SYMBOLS AND ABBREVIATIONS 895

FORMAL REVIEWS OF THE COGARN REPORT 899

NUMBER 10/11

PROCEEDINGS OF THE SOVIET-AMERICAN SYMPOSIUM MOSCOW, JUNE 1985

Preface
Robert H. Socolow and Marc Ross v

I. THE GENERAL CONTEXT OF ENERGY CONSERVATION

A. Overview

Energy conservation in the global context
Thomas B. Johansson and Robert H. Williams 907

The economical use of energy resources
M. A. Styrikovich 921

A low energy future for the United States
Robert H. Williams 929

Basic principles of energy policy in the U.S.S.R.
A. A. Makarov, A. A. Beschinsky and A. G. Vigdorchik 945

Strategies for conservation of fuel and energy resources in the Leningrad Region
I. A. Glebov and V. P. Kovalenko 949

Energy demand and materials flows in the economy
Marc Ross, Eric D. Larson and Robert H. Williams 953

B. Environmental Issues

Energy development and its effect on the environment
Yu A. Izrael 969

Global environmental issues related to energy supply: the environmental case for increased efficiency of energy use
John P. Holdren 975

C. Nuclear Energy

Nuclear energy without reprocessing: a future made possible by energy conservation
Harold Feiveson 993

Reactor systems aspects of the future development of thermonuclear energy in the U.S.S.R.
E. P. Velikhov and A. V. Nedospasov 1003

II. ENERGY CONSERVATION IN BUILDINGS

Energy consumption in the residential and public services sector
M. V. Tarnizhevsky 1009

Energy conservation and improvement of reliability in centralized heating systems
V. Varvarsky, Ya. Kovyliansky and S. Chistovich 1013

Energy-efficient U.S. buildings and equipment: progress toward least lifecycle cost
Arthur Rosenfeld 1017

Field studies of energy savings in buildings: a tour of a 15-year research program at Princeton University
Robert H. Socolow 1029

III. ENERGY CONSERVATION IN TRANSPORTATION

Energy conservation in transportation
D. P. Velikanov, O. A. Stavrov and M. L. Zamyatin 1047

Rating of hazardous substance emissions by vehicular transport as a means of improving the environment of large cities
O. A. Stavrov and M. A. Boyeva 1057

Automobile fuel economy
Frank von Hippel 1063

Adiabatic Diesel-engine technology in future transportation
Roy Kamo 1073

IV. ENERGY CONSERVATION IN INDUSTRY

A. Systems

Integrated energy generation and industrial processing as a method of energy conservation
E. P. Velikhov, V. M. Maslennikov, A. E. Sheindlin, E. E. Shpilrain and V. Ya Shterenberg 1083

Direct-contact heat exchange, shale production, and slag processing as examples of new efficient technologies for power generation
R. B. Akhmedov, Z. L. Miropolsky, E. V. Samuilov and G. P. Stelmakh 1097

Energy conservation in the transmission and distribution of electricity in the Soviet Union
I. G. Karapetian, A. L. Kudoyarov, U. S. Zhelezko and V. E. Vorotnitski 1107

Electricity and industrial productivity: a technical and economic perspective
Philip S. Schmidt 1111

Advanced separation techniques for petrochemicals
Thomas W. Mix 1121

B. Steel

Industrial energy conservation and the steel industry of the United States
Marc Ross 1135

Energy considerations of classical and new iron- and steel-making technology
Sven Eketorp 1153

Technological progress and energy conservation in the iron and steel industry of the U.S.S.R.
N. P. Lyakishev and N. I. Perlov 1169

Technological approaches to energy saving in blast-furnace operations in the iron and steel industry of the U.S.S.R.
N. I. Perlov 1177

Energy conservation and productivity improvements in steel plants
Elias P. Gyftopoulos and Wayne J. DiBartola 1183

NUMBER 12

L. Schipper, A. Ketoff, S. Meyers and D. Hawk	1197	Residential electricity consumption in industrialized countries: changes since 1973
Edward Vine	1209	Air-to-air heat exchangers and the indoor environment
Robert D. Perlack and J. Warren Ranney	1217	Economics of short-rotation intensive culture for the production of wood energy feedstocks
O. A. Salman, A. Bishara and A. Marafi	1227	An alternative to the Claus process for treating hydrogen sulfide
John H. Herbert, Scott Sitzer and Yvonne Eades-Pryor	1233	A statistical evaluation of aggregate monthly industrial demand for natural gas in the U.S.A.
Charles M. Macal, Mark J. Bragen and John E. Marshall	1239	An integrated energy planning model for Illinois
Ho-Ming Yeh and Lie-Chaing Chen	1251	Experimental studies on double-effect solar distillers
V. Bahel	1257	Statistical comparison of correlations for estimation of the diffuse fraction of global radiation
Bruce Tonn and Dennis White	1265	Residential demand for wood: results from the U.S. Pacific Northwest
O. A. Salman and A. I. Bishara	1275	Selective separation of hydrogen sulfide by pressure-swing adsorption
The-Hiep Nguyen	1281	The stability of energy coefficients
S. M. Jeter, W. J. Wepfer, G. M. Fadel, N. E. Cowden and A. A. Dymek	1289	Variable speed drive heat pump performance
David L. Greene, Antony Araya Jacome, Robert Kowalski and Patricia S. Hu	1299	Road transport energy conservation in Costa Rica
V. Bahel, R. Srinivasan and H. Bakhsh	1309	Statistical comparison of correlations for estimation of global horizontal solar radiation
Carl Blumstein	1317	Non-sampling errors in surveys of residential energy consumption
K. Leledakis, T. Goumas and J.-E. Samouilidis	1329	Soft energy sources in regional energy systems: the case of the Cyclades

Note

J. M. Gordon 1333 Low heat loss double-glazed windows

I Software Survey Section